



EXAM PAPERS PRACTICE

On the Wild Side -4

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: On the Wild Side -4

Type: Mark Scheme

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful



Mark Scheme

Q1.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|---------------------|------------|
| | <p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• methane is a greenhouse gas (1)• greenhouse gases {absorb / trap} {heat / infra red / long wave} energy (1)• (anaerobic oxidation of methane results in) less methane in the atmosphere (1)• (the breakdown of methane) could {reduce the greenhouse effect / result in less heat being trapped / reduce global warming} (1) | | (3) |



Q2.

| Question Number | Indicative content |
|-----------------|---|
| | <p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>Section of relevant data</p> <ul style="list-style-type: none">• higher rate of mutations than in {slowly evolving fish / sticklebacks}• relatively high rate of mutations that change amino acids compared to slowly evolving fish• low rate of gene duplication in slowly evolving fish / high rate of gene duplication in cichlid fish• higher rate of mutations in regulatory sequences in cichlid fish• variety of habitats available providing different selection pressures <p>Consequences of data described</p> <ul style="list-style-type: none">• more {amino acid changes / gene duplications} the greater number of alleles in gene pool• altered amino acids result in altered protein function• changes in regulatory sequences allow for different gene expression in tissues etc• duplicated genes can be used for new functions without loss of original function / polygenic phenotypes• variety of habitats provide a number of niches suitable for cichlid fish with different adaptations to exploit <p>Linkages made to rate of evolution</p> <ul style="list-style-type: none">• example of an altered protein function e.g. enzymes that work at different pH / temperature tolerance• development of new phenotypes• {new enzymes/ different mouth shapes} allow new food types to be exploited• changes in {pigmentation / mouth shape} allow speciation |



EXAM PAPERS PRACTICE

| Level | Mark | Descriptor | Additional guidance |
|---------|-------|--|--|
| Level 0 | Marks | No awardable content | |
| Level 1 | 1-3 | <p>Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made.</p> <p>Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures.</p> <p>The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.</p> | <p>At least one relevant piece of data described e.g. higher mutation rate.</p> <p>A consequence described for the data – e.g. linking mutations to protein structure</p> <p>Basic clear conclusion attempted e.g. different proteins are produced</p> |
| Level 2 | 4-6 | <p>Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts.</p> <p>Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures.</p> <p>The discussion shows some linkages and lines of scientific reasoning with some structure.</p> | <p>At least two pieces of relevant data referred to.</p> <p>Consequences of at least two pieces of data explained</p> <p>Linkages made to evolution of the fish e.g. changes in phenotype</p> |
| Level 3 | 7-9 | <p>Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts.</p> <p>Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures.</p> <p>The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.</p> | <p>At least three pieces of relevant data referred to</p> <p>Consequences of each piece of data explained</p> <p>Linkages to evolution discussed, e.g. the types of adaptations that may arise due to mutations</p> |



Q3.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|---|------------|
| (i) | <ol style="list-style-type: none">idea that bacteria are resistant to fewer {antibiotics / antibiotic combinations} (in 2006 than 2007) ;in both years there are resistant strains to {streptomycin / INH + rifampicin + ethambutol / INH } ;idea that there are resistant strains to INH + rifampicin in 2006 but not in 2007 ;idea that there are resistant strains to {ethambutol / rifampicin} in 2007 but not in 2006 ; | <p>ACCEPT clear abbreviations to the names of the antibiotics throughout</p> <p>1 ACCEPT a description e.g. new resistances, resistant to 4 in 2006 and 5 in 2007</p> <p>3 ACCEPT idea that {resistance decreased to zero / no longer resistant}</p> <p>4 ACCEPT idea of resistance developing NB development of new resistances to {ethambutol / rifampicin} = Mp 1 and 4</p> | (3) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (ii) | <ol style="list-style-type: none">1. bacteria have a mutation in {DNA / gene / eq } ;2. idea that the {presence / usage of} {antibiotic (INH) / INH} acts as a selection pressure ;3. idea that the allele (for resistance) is passed on ;4. idea that bacteria {divide by asexual reproduction / divide by binary fission / produce clones / eq} ;5. idea of increasing the allele frequency ; | <p>3 NOT gene</p> <p>4 ACCEPT divide by mitosis / conjugation / transduction / transformation / eq</p> | |



| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|---------------------|------------|
| | 6. idea that the more resistant bacteria there are, the more likely new strains will acquire the (resistance) gene ; | | (3) |





EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|---|------|
| (iii) | <ol style="list-style-type: none">reference to codes of {practice / conduct / eq } ;idea that appropriate {antibiotics / named example} should be given to patients ;idea of {educating patients about taking antibiotics / taking the full course of antibiotics ;credit another appropriate procedure e.g. hand washing, screening ; | <p>1 ACCEPT named policy /code NB Mp5 is for named practice</p> <p>2 ACCEPT not giving antibiotics if not necessary / not using antibiotics for prophylactic treatment / using narrow spectrum antibiotics / rotate antibiotic use</p> | (2) |



EXAM PAPERS PRACTICE

Q4.



EXAM PAPERS PRACTICE



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| Question Number | Acceptable Answer | Additional Guidance | Mark |
|-----------------|---|---------------------|------------|
| (a)(i) | net (primary) productivity = gross (primary) productivity - respiration | Allow NPP = GPP - R | (1) |

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|-----------------|-------------------------|-----------------------------------|------------|
| (a)(ii) | correctly plotted value | 2.3 at 0 1.4 at 6 0.9 at 18 | (1) |

EXAM PAPERS PRACTICE



| Question Number | Acceptable Answer | Additional Guidance | Mark |
|-----------------|--|---------------------|------------|
| (a)(iii) | <p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• there will be a large decrease in net productivity as depth increases (1)• (due to) large decrease in gross productivity as depth increases (1)• lower light intensity results in less photosynthesis (1)• and (only a) small decrease (in utilisation of carbon) in respiration as depth increases (1) | | (3) |



| Question Number | Indicative content | |
|-----------------|--|--|
| * (b) | <p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <ul style="list-style-type: none">• burning fossil fuels increases atmospheric concentrations of CO₂, a greenhouse gas leading to rising sea levels, increased surface temperatures and increased CO₂ concentration in oceans• small changes in sea level have limited effect on the crustose coralline algae• algae are adversely affected by increased carbon dioxide concentrations• there is a greater effect of increased carbon dioxide at higher temperatures• continued burning of fossil fuels may reduce productivity of crustose coralline algae• reefs will grow more slowly, become more susceptible to damage resulting in loss of habitat | |
| Level | Mark | Descriptor |
| Level 0 | Marks | No awardable content |
| 1 | 1-2 | <p>An answer may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information.</p> <p>The answer will contain basic information with some attempt made to link knowledge and</p> |



EXAM PAPERS PRACTICE

| Level | Mark | Descriptor |
|-------|------|---|
| | | understanding to the given context. |
| 2 | 3-4 | <p>An answer will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.</p> <p>The answer shows some linkages and lines of scientific reasoning with some structure.</p> |
| 3 | 5-6 | <p>An answer is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.</p> <p>The answer shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.</p> |

Q5.

| Question Number | Answer | Mark |
|-----------------|---|-----------------|
| | <p>The only correct answer is B 3</p> <p>Global warming is not caused by a reduction in greenhouse gases</p> <p>Global warming is not affecting only the ice caps</p> | Computer (1) |



EXAM PAPERS PRACTICE

Q6.

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|-----------------|--|---------------------|------------|
| | <p>An answer that makes reference to the following points:</p> <ul style="list-style-type: none">• systematic sampling (1)• quadrats used at the tops and in between dunes (1)• details of method used for measuring percentage cover (1)• repeats to make a valid comparison (1)• a named relevant statistical test (1) | | (5) |

EXAM PAPERS PRACTICE



Q7.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|---|------------|
| | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">• negative correlation described (1)• polar bears eating fewer seals (1)• as the length of time that ice is present decreases more polar bears are seen on land (1)• (because polar bears are on land more often) more eggs are eaten (1) | <p>e.g. as presence of ice decreases the number of eggs taken increases</p> <p>ALLOW hunting / feeding on / catching</p> <p>ALLOW polar bears seen more often on land</p> | <p>(4)</p> |



Q8.

| Question Number | Indicative content |
|-----------------|--|
| * | <p>Answers will be credited according to candidates' deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is relevant. Additional content included in the response must be scientific and relevant.</p> <p>Give examples of relevant biological knowledge and understanding:</p> <p>Evidence of isolated elements of biological knowledge:</p> <ul style="list-style-type: none">• glucose for respiration in both• starch for energy storage in plants / glycogen for energy storage in animals• cellulose for cell walls in plants <p>Evidence of adequate biological knowledge with linkages made</p> <ul style="list-style-type: none">• starch composed of amylose and amylopectin in plants• sucrose as a transport sugar in phloem in plants, glucose in animals• lactose in milk for energy• a judgement on the importance of carbohydrates in plants and animals is made e.g. cellulose as a structural carbohydrate in plants therefore a greater proportion of carbohydrate in plants than animals or animals require more energy, therefore need more carbohydrate <p>Evidence for comprehensive biological knowledge and understanding with sustained linkages</p> <ul style="list-style-type: none">• pentose sugars ribose and deoxyribose { in nucleic acids / DNA/ RNA / ATP} in both• ribulose as part of the Calvin cycle in plants• glycoprotein in { mucus / receptors on cell surface membranes / antibodies}• glycolipids in cell membranes• a supported judgement on the relative importance of carbohydrates in plants and animals is given e.g. animals store more energy in lipids than carbohydrate, therefore carbohydrate more important as a storage molecule in plants or the idea of carbohydrates as part of complex molecules or the proportion of carbohydrates present is not the same as importance |



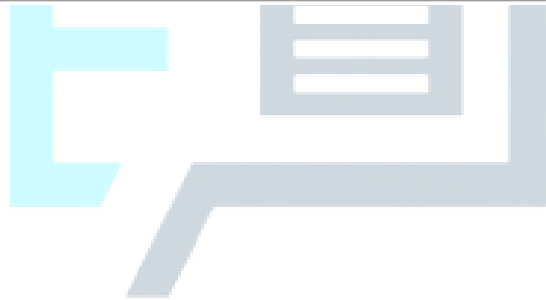
EXAM PAPERS PRACTICE

| Level | Mark | Descriptor | Additional guidance |
|-------|------|---|--|
| 0 | 0 | No awardable content | |
| 1 | 1-3 | <p>Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made.</p> <p>A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.</p> | <p>Glucose for respiration Polysaccharides for energy storage Cellulose for plant cell walls</p> <p>Simple conclusion made</p> |
| 2 | 4-6 | <p>Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts.</p> <p>A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.</p> | <p>Branched storage molecules for rapid energy release in starch Roles of sucrose, lactose</p> <p>A judgement on the importance of carbohydrates in plants and animals is made</p> |
| 3 | 7-9 | <p>Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts.</p> <p>A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.</p> | <p>All of the above plus discussion of carbohydrates as part of complex molecules</p> <p>A supported judgement on the relative importance of carbohydrates in plants and animals</p> |



Q9.

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|-----------------|---|--|------------|
| (i) | <ul style="list-style-type: none">• correct calculation of numerator (1)• correct calculation of denominator (1)• correct calculation of diversity index / correctly plotted on the graph (1) | <p><u>Example of calculation:</u> $(N(N-1) = 427 \times 426 = 181\,902)$ $\div (\Sigma n(n-1) =) 52\,320)$</p> <p>$= 3.48 ;$</p> <p>Allow full marks for correct answer with no working</p> | (3) |





EXAM PAPERS PRACTICE

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|-----------------|--|---|------------|
| (ii) | <p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none">• succession is the sequence of { species / communities } replacing each other with time (1)• dune 4 is older than dune 1 (1)• no species of plant inhabits all 4 dunes /example from table quoted to show one species inhabiting no more than 3 dunes (1)• plant diversity increases with time (1)• description of increasing diversity index from dune 1 to dune 4 (1) | <p>e.g. species G only found on dunes 3 and 4</p> | (5) |

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EXAM PAPERS PRACTICE

Q10.



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EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--------|---------------------|------|
| (a) | A ; | | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|---|------|
| *(b) | <p>QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence</p> <ol style="list-style-type: none">1. idea that biofuel production may (overall) results in more carbon dioxide in the atmosphere ; <p>OR</p> <p>idea that carbon neutral means that the carbon dioxide produced equals the carbon dioxide used ;</p> <ol style="list-style-type: none">2. idea of forests as carbon {sinks / eq} ;3. idea that {clearing land / deforestation} results in (net) increase in carbon dioxide (in atmosphere) ;4. (less plants means) less carbon dioxide {removed / used / eq} by photosynthesis ;5. {burning / eq} trees produces carbon dioxide ;6. idea that (increased) decomposition produces carbon dioxide;7. idea of using {(fossil) fuels / petrol / diesel} by {lorries / machinery / eq} produces carbon dioxide ;8. {burning /eq} of biofuels produces carbon dioxide ; | <p>QWC emphasis is clarity of expression</p> <p>Accept stores / sumps</p> | (5) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (c) | <ol style="list-style-type: none">reference to production of {greenhouse gases / named greenhouse gas} ;idea that these gases {build up/ remain / form a layer} in (upper) atmosphere;which {absorb / trap / eq} {heat energy / infra-red / IR / eq} ;reflected from earth's surface ;idea that increased levels of these gases increase the greenhouse effect ;idea that (mean) temperature of earth's {surface / atmosphere} is increasing ; | <p>Accept carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen Not methane</p> <p>Accept long wavelength light</p> | (4) |



EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

Q11.

| Question Number | Answer | Mark |
|-----------------|------------------------------|------|
| (a)(i) | A carbon dioxide and methane | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (a)(ii) | <ol style="list-style-type: none">1. idea that {using / burning} {fossil fuels / petrol / diesel} releases carbon dioxide ;2. reference to {carbon dioxide / CO₂} as a greenhouse gas ;3. idea that carbon dioxide is taken in for {photosynthesis / light-independent reaction / carbon fixation / eq} (during production of plants for biofuels) ;4. idea of no net change of carbon dioxide in the atmosphere when biofuels are burnt / eq ; | <ol style="list-style-type: none">1. NOT methane Ignore burning biofuels releases carbon dioxide4. ACCEPT biofuels are carbon neutral | (3) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|----------------------------------|------|
| (b)(i) | (plant) fibres / woody parts / xylem (vessels / tissue) / sclerenchyma (fibres / tissue) / lignified tissue / eq ; | ACCEPT vascular bundles / tissue | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|------|
| (b)(ii) | <ol style="list-style-type: none">1. idea that bacteria cannot breakdown cellulose fast enough ;2. idea that {enzymes / cellulase} needed to break down cellulose into (β) glucose ;3. by hydrolysing (1,4) glycosidic bonds / eq ;4. idea of {respiration / fermentation} of {glucose / eq} (by bacteria) ; | <ol style="list-style-type: none">2. NOT hydrogen bonds3. ACCEPT breaking | (2) |

EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|------------|
| (c) | <p>1. idea that production of first generation biofuel increases until 2016 and then level off ;</p> <p>2. idea that production of second generation biofuel will continue to increase ;</p> <p>For second generation biofuels:</p> <p>3. idea that second generation biofuels do not affect food supply ;</p> <p>4. idea that made using the non-edible components ;</p> <p>5. cheaper ;</p> <p>6. idea that people are becoming more responsible for their environment ;</p> | <p>Piece mp 1 and 2 together</p> <p>ACCEPT the converse of mps 3, 4 and 5 in context of first generation biofuel production</p> <p>4. ACCEPT (cellulose and) lignin idea of less waste</p> | (4) |



EXAM PAPERS PRACTICE

Q12.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|---------------------|------|
| (a)(i) | C ; The number of fires in Mato Grosso each year is always higher than other areas ; | | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|------|
| * (a)(ii) | <p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence</p> <ol style="list-style-type: none">1. reference to {fires / burning / eq} produces carbon dioxide ;2. which is a greenhouse gas ;3. idea that these gases {build up / remain / form a layer / increase} in (upper) atmosphere ;4. which {absorb / trap / eq} {heat energy / infra red / IR / eq} ;5. reflected from earth's surface ;6. idea that increased levels of these gases increase the greenhouse effect ;7. idea that (mean) temperature of earth's {surface / atmosphere} is increasing ;8. idea that less carbon dioxide {removed / used / eq} by photosynthesis ; | <p>QWC emphasis clarity of expression</p> <p>1. Accept carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen Not methane</p> <p>2. NB do not penalise ref to methane twice</p> <p>4. Accept long wavelength light</p> | (5) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (b)(i) | <ol style="list-style-type: none">1. reference to biofuels being (possibly)carbon neutral ;2. idea that {plants / crops} are used for biofuels ;3. idea that carbon dioxide used for photosynthesis (by plants / in production of biofuels) ;4. idea of using biofuels to replace fossil fuels ; | <p>Ignore carbon unqualified</p> <p>1. Accept idea of no (net) change in carbon dioxide levels in atmosphere</p> | (3) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (b)(ii) | <ol style="list-style-type: none">land has to be cleared to grow plants for biofuels / eq ;burning produces carbon dioxide / the plants growing there would have been {photosynthesising / using carbon dioxide} / machinery uses fossil fuels / loss of habitat ; OR <ol style="list-style-type: none">decomposition of dead plant material (after clearing) / eq ;produces carbon dioxide / eq ; OR <ol style="list-style-type: none">idea that the land could have been used for food production ;less food produced / eq ; OR <ol style="list-style-type: none">ref to use of fertilisers ;idea of eutrophication OR use oil-based products ; | <p>Mark as pairs</p> <p>1 Accept reference to deforestation of land to grow plants for biofuels</p> <p>6 Accept shortage of food, contributes to world hunger, idea of causing starvation</p> | (2) |

Q13.

| Question Number | Answer | Mark |
|-----------------|--------|------|
| (a) | B 2 | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|---------------------|------|
| (b)(i) | <ol style="list-style-type: none">(only) contain hydrogen, carbon and oxygen ;reference to fatty acids and glycerol {joined by / eq} ester{bonds / eq} ;idea of saturated and unsaturated (fatty acids / lipids); | | (2) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|------|
| (b)(ii) | <ol style="list-style-type: none">uses less fertiliser / eq ;idea of not using more pesticides / eq ;idea that greenhouse gas emissions are not that different ;credit manipulation of figures to support marking point 3 ; | <p>1. & 2. IGNORE comparisons between the different crops</p> <p>3. ACCEPT less than corn but more than sugar cane</p> | (3) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (b)(iii) | <ol style="list-style-type: none">credit three correctly named ions ;nitrate for {protein / amino acids / nucleic acids / named nucleic acid} ;proteins used for growth ;calcium ions for {other nutrients uptake / promotes cell elongation / strengthen cell walls / enzyme function / protection against heat stress / protection against diseases / eq} ;magnesium ions for chlorophyll production ;for photosynthesis ; | <p>1. e.g. nitrates, calcium ions, magnesium ions, sulphates, potassium ions, phosphates</p> <p>ACCEPT</p> <p>Sulphates for amino acids</p> <p>Potassium ions for stomata function</p> | (4) |



EXAM PAPERS PRACTICE

Q14.



EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

| Question number | Answer | Additional guidance | Mark |
|-----------------|---|---|----------------------------|
| (i) | An answer that makes reference to two of the following: <ul style="list-style-type: none">• food availability (1)• interspecific competition (1)• predation (1)• disease (1) | IGNORE time of year / availability of resources ALLOW grazing / migration IGNORE competition unqualified or competition between birds | Choose an item. (2) |

| Question number | Answer | Additional guidance | Mark |
|-----------------|--|--|----------------------------|
| (ii) | <ul style="list-style-type: none">• correct expected value (1)• correct values for observed minus expected squared (1)• correct answer (1) | $26 \div 2 = 13$ $(16 - 13)^2 = 9$ and $(10 - 13)^2 = 9$ 1.38 ECF for incorrect expected value ALLOW one mark for 2.25 / 3.6 | Choose an item. (3) |



EXAM PAPERS PRACTICE

| Question number | Answer | Additional guidance | Mark |
|-----------------|--|--|-----------------------------------|
| (iii) | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">cutting down trees decreases the number of bird species in both forests (1)the decrease is significant (at $p=0.05$) in forest A (1)the decrease was not significant (at $p=0.05$) in forest B (1) | <p>ALLOW decreases species richness</p> <p>ALLOW less than {5% / 0.05 probability} reduction in forest A due to chance</p> <p>ALLOW more than than {5% / 0.05 probability} reduction in forest B due to chance</p> <p>ALLOW 1 mark chi squared value was {greater than the critical value for forest A / less than critical value for forest B} with no reference to p value or significance</p> | <p>Choose an item.</p> <p>(2)</p> |

Q15.

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---|------------|
| | <p>An answer that makes reference to</p> <ul style="list-style-type: none">correct method for calculation the change in value (1)correct answer (1) | <p><u>Example of calculation</u></p> <p>$405 \div 1.46$</p> <p>277.4 (ppm)</p> <p>ALLOW 277</p> <p>Correct answer without working gains full marks</p> | <p>(2)</p> |



EXAM PAPERS PRACTICE

Q16.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|---|------------|
| (i) | <ul style="list-style-type: none">correct answer to four significant figures (1) | <u>Example of calculation</u> $6.44 \div 10 = 0.644$ (mm) | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|------------|
| (ii) | An explanation that makes reference to the following: <ul style="list-style-type: none">divide change in mean length by time (1)comparison between the rate for 3% and 5% (1) | ALLOW (growth) rate = change in mean length \div time ALLOW grow faster in 5% | (2) |

Q17.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|---|------------|
| (i) | <ul style="list-style-type: none">correct measurements from the photograph (1)correct answer | <u>Example of calculation</u> Starch grain 27mm and width of chloroplast 60mm $27000 \div 22 = 12\ 273$ $60000 \div 12\ 273 = 4.889$ (μm) ALLOW 4.9 / 4.89 / 4.8 recurring (μm) (ALLOW one mark for correct calculation from different measurements) | (2) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|---|--|------|
| (ii) | <p>An explanation that makes reference to three of the following:</p> <ul style="list-style-type: none">• (granum) is formed from many layers of thylakoid membranes to increase surface area (for absorbing light)• thylakoid membranes contain chlorophyll to absorb light• electron carrier molecules in thylakoid membrane involved in ATP production | <p>ALLOW stacks of thylakoids provide a large surface area</p> <p>ALLOW photosystems / photosynthetic pigments in place of chlorophyll</p> <p>ALLOW for light dependent reaction in place of absorb light</p> <p>ALLOW ATP synthase / photophosphorylation</p> | (3) |

Q18.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|---|------|
| | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">• transfer carbon from an {inorganic source / CO₂} into organic compound (1)• that becomes part of the mass of that organism (1) | <p>ALLOW correct named organic compound e.g. cellulose / protein</p> <p>ALLOW description of light independent reactions of photosynthesis</p> <p>ALLOW part of biomass</p> | (2) |



Q19.

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---|------------|
| | <p>An explanation that makes reference to the following</p> <ul style="list-style-type: none">• carbon dioxide produced by burning wood replaces that absorbed by the trees (1)• trees absorb carbon dioxide (from the atmosphere) for photosynthesis (1)• new trees are grown to replace those that are cut down (1)• therefore no net increase in carbon dioxide (1) | <p>ALLOW converse</p> <p>ALLOW fix carbon</p> <p>ALLOW carbon neutral</p> | <p>(4)</p> |

Q20.

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|----------|
| (i) | <ul style="list-style-type: none">• correct values for carbon released by boreal forest and deciduous forest respiration (1)• correct use of values to calculate percentage increase (1)• correct answer (1) | <p><u>Example of calculation</u></p> <p>1013 – 322 = 691 (Boreal) 2165 – 1301 = 864 (Deciduous)</p> <p>= 173 ÷ 691</p> <p>deciduous release 25% (25.04%) more than boreal</p> <p>Correct answer with no working gains full marks</p> | <p>3</p> |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional Guidance | Mark |
|-----------------|--|--|------|
| (ii) | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none">the ratio of NPP to GPP is higher in deciduous forests (1)NPP is higher / more of the carbon (fixed) is used to produce biomass (1)(in deciduous forests) more carbon (dioxide) removed (by photosynthesis) than returned by respiration (1) | ALLOW converse for boreal forests for all points | 3 |

Q21.

| Question Number | Answer | Mark |
|-----------------|--|------|
| | <p>The only correct answer is A absorbs infrared radiation reflected by the surface of the Earth</p> <p><i>B is incorrect because it does not absorb ultraviolet</i></p> <p><i>C is incorrect because it does not reflect infrared</i></p> <p><i>D is incorrect because it does not reflect ultraviolet</i></p> | (1) |



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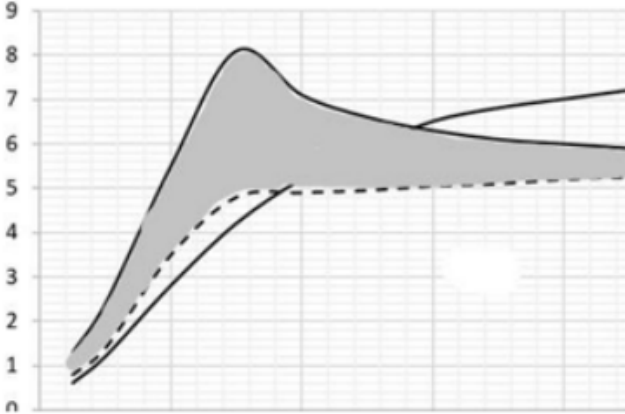
Q22.



EXAM PAPERS PRACTICE



EXAM PAPERS PRACTICE

| Question number | Answer | Additional guidance | Mark |
|-----------------|--|--|---------------------|
| (i) | Choose an item.  | ALLOW solid or hatched shading Shading must be complete (e.g. not stop at biomass line) | Graduate (1) |

| Question number | Answer | Additional guidance | Mark |
|-----------------|---|---|-------------------|
| (ii) | A description that makes reference to the following: <ul style="list-style-type: none">• change in communities (1)• (taking place) over time (1) | ALLOW change in species ALLOW a description of succession as a change from pioneer species to climax communities | Expert (2) |



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| Question number | Answer | Additional guidance | Mark |
|-----------------|---|--|---------------|
| (iii) | <p>An answer that makes reference to three of the following:</p> <ul style="list-style-type: none">• (the energy lost in) respiration {levels off / stops increasing} (1)• accumulation of (the energy incorporated into) biomass continues (1)• therefore, with succession more carbon dioxide is fixed (1)• reduces the amount of carbon dioxide (in the atmosphere) (1) | <p>ALLOW more carbon sinks</p> <p>ALLOW more photosynthesis to remove carbon dioxide</p> <p>ALLOW (with succession) carbon dioxide released from respiration is less than the carbon dioxide fixed (by RUBSCO)</p> | Expert (3) |

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Q23.

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---|-----------------|
| (i) | <p>An answer that makes reference to the following</p> <ul style="list-style-type: none">• species D (1)• correct calculation of percentage change as {43.3/ 43} % (1) | <p>Example of calculation</p> $(215-150) \div 150 \times 100$ | graduate (2) |



EXAM PAPERS PRACTICE

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|---|------------|
| (ii) | <p>An explanation that makes reference to four of the following</p> <ul style="list-style-type: none">• the rate of growth increases as rate of photosynthesis increases (1)• growth rate is higher for plants grown at a higher light intensity (1)• role of light in light-dependent reactions described (1)• more photosynthesis means more {glucose/carbohydrate} produced (1)• (more carbohydrate produced) means more glucose for {energy/respiration } (1) | <p>ALLOW correlation between rate of growth and rate of photosynthesis</p> <p>e.g. photolysis / photophosphorylation – production of ATP or reduced NADP</p> <p>ALLOW other named product of photosynthesis</p> | Expert (4) |

EXAM PAPERS PRACTICE



Q24.

| Question Number | Answer | Mark |
|-----------------|---|-----------------------|
| | <p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>Indicative content</p> <ul style="list-style-type: none">• Use shade tolerant and shade intolerant plants• Plants grown in the same conditions e.g. temperature, humidity• Plants grown in either 5% light or 25% light or a range of light intensities• Take same masses of leaf• Add to equal volume of isolation medium• Homogenise (e.g. blend / grind in pestle and mortar) for same length of time• Filter suspensions of plant material (through muslin) or centrifuge to concentrate chloroplasts• Resuspend pellet of chloroplasts if centrifuged• Expose suspensions to 5% and 25% light intensity• Keep temperature controlled• Add DCPIP and record time for DCPIP to decolourise• Carry out repeats to calculate mean time to decolourise the DCPIP• If the difference is due to the light dependent reaction, shade tolerant plants would decolourise more quickly at lower light intensity | <p>Expert (6)</p> |



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| Level | Marks | | Additional Guidance |
|-------|-------|---|---|
| 0 | 0 | No awardable content | |
| 1 | 1-2 | <p>An explanation of how the investigation should be modified may be attempted but with limited analysis, interpretation and/or evaluation of the scientific information. Generalised comments made.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p> | <p>Compare shade tolerant and shade intolerant plants (allow A and C from the table)</p> <p>Control of at least one relevant variable</p> <p>Reference to different light intensities</p> |
| 2 | 3-4 | <p>An explanation of how the investigation should be modified will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows some linkages and lines of scientific reasoning with some structure.</p> | <p>Growing plants at different light intensities</p> <p>Use of DCPIP to measure rate of photosynthesis</p> <p>Correct description of methodology</p> <p>Sensible number of repeats</p> <p>Correct change in DCPIP/use of colorimeter to measure colour change</p> |



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| | | | |
|---|-----|---|---|
| 3 | 5-6 | <p>An explanation of how the investigation should be modified is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured.</p> | <p>Link between change in DCPIP and rate of photosynthesis</p> <p>Link with light dependent reaction</p> <p>How this would support the difference between shade tolerant and shade intolerant plants</p> <p>Use of a named statistical test eg T test</p> |
|---|-----|---|---|



Q25.

| Question Number | Answer | Additional guidance | Mark |
|-----------------|-------------|---------------------|------|
| | Chloroplast | | (1) |

EXAM PAPERS PRACTICE